MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

TSA2151 SYSTEM ADMINISTRATION AND MAINTENANCE

(All Sections / Groups)

15 OCTOBER 2019

2:30 PM - 4:30PM

(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 8 pages including cover page.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Write all your answers CLEARLY in the Answer Booklet provided.

Question 1

A. Unix-like operating system can be grouped into two categories as open source and proprietary. Identify TWO (2) examples for each category. (2 marks)

B. A desktop manager (desktop environment) is a suite of tools in Linux operating system which make it easier for you to use your computer.

i) Briefly explain TWO (2) components of a desktop environment. (2 marks)

ii) List TWO (2) examples of desktop environment in Linux. (2 marks)

C. Linux being a multi-user system, used permissions and ownership for security.

i) Briefly explain a concept of user permissions and ownership in Linux. (2 marks)

ii) Current permission for file report.pdf is `rw- rw- r--` . (1 mark)

a. Use suitable command to change the permission to `rwx rw- r--`.

b. Use ls command with suitable option to see the changes. (1 mark)

Question 2

A. Zone DNS database is a collection of resource records and each of the records provides information about a specific object. Explain FOUR (4) most common records in zone DNS database. (4 marks)

B. ISPConfig is a software package that permits the easy management of servers, webspace, resellers and single virtual hosts. Identify THREE (3) level of system administration in ISPConfig. (3 marks)

C. The File Transfer Protocol (FTP) is a standard network protocol used for the transfer of computer files between a client and server on a computer network.

i. FTP still widely used even though it considered an outdated protocol. Give TWO (2) deployment scenario of FTP that considered relevant and widely used. (2 marks)

ii. Give an `apt` command to install a FTP server named `vsftpd`. (1 mark)

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Question 3

A. Apache2 is a modular server. This implies that only the most basic functionality is included in the core server. Extended features are available through modules which can be loaded into Apache2.

i) Briefly describe `mod-available` and `mod-enable`. (2 marks)

ii) Explain how to list all available module under Apache2. (1 mark)

iii) Identify a module that allows user-specific directories to be accessed via Apache2. (1 mark)

iv) Give a command to enable module above. (1 mark)

v) Given an IP address: `10.0.88.173` and username: `debian`, give correct URL to access `debian` directory using web browser. (1 mark)

B. Web server benchmarking is the process of estimating a web server performance in order to find if the server can serve sufficiently high workload. Identify ONE (1) performance measure for web server benchmarking. (1 mark)

C. Linux virtualization refers to running one or more virtual machines on a physical computer that's operated by the Linux operating system. Briefly discuss THREE (3) open source Linux virtualization software. (3 marks)

Question 4

A. Bash scripting is an extremely useful and powerful part of system administration and development.

i. Give THREE (3) methods to run Bash script. (3 marks)

ii. Name TWO (2) special variable under Bash script. (2 marks)

B. Write BASH script based on an output below. (3 marks)

```
ibrahim@osboxes: ~
ibrahim@osboxes:~$ bash add-number.sh
Enter first number
2000
Enter second number
20
The result of addition = 2020
ibrahim@osboxes:~$
```

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C. You can use two different daemons to schedule a commands: the `at daemon (atd)` and the `cron daemon (crond)`. The `at daemon` can be used to schedule a command to execute once in the future, whereas the `cron daemon` is used to schedule a command to execute repeatedly in the future.

i) Using `at`, write a command to run a task at 02:30 a.m. on July 15. (1 mark)

ii) Using `cron`, write a command to run a task on every Tuesday at 4:00am. (1 mark)

Question 5

CASE STUDY: LINUX

The Linux kernel – the core of the Linux operating system – is the result of one of the largest and most successful cooperative software projects ever attempted.

Linux is the world's most dominant operating system. Launched in 1991 by Linus Torvalds, it's the gold standard of user-led open source innovation, representing Linus' desire for an OS that he could run on his personal computer.

Since those early days, developers from large hardware companies to small emerging technology providers have contributed to Linux, building solutions that run on top of the open-source OS.

Between 2005 and 2016, more than 14,000 individual developers from more than 1,300 companies contributed to the Linux kernel project. In an industry that features fierce competition between companies, it's amazing to see a project with common, shared resources developed on a massive scale.

Regular two-to-three month releases deliver stable updates to Linux users, adding significant new features, enhanced device support, and improved performance. The rate of change in the kernel has been historically high, and continues to increase – more than 10,000 patches often go into each kernel release. Each release contains the work of more than 1,600 developers, representing 200+ companies worldwide.

But this cooperation isn't just limited to the Linux kernel. In 2005, the world saw the rise of the powerful Git revision control tool. When BitKeeper no longer met the Linux kernel community's need for a distributed system, Linus Torvalds took the challenge into his own hands. Disappearing over the weekend to build a new tool, he emerged with Git, software that has ushered in a new level of social coding among developers. Git forms the basis of GitHub, the single largest open-source repository online today.

Together, Linux and Git – both created by Linus Torvalds – are the two most highly rated open-source projects in history. But let's step back to the early days of this project

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The Challenge

After it was created in AT&T's Bell Laboratories in the 1970s, the UNIX operating system saw success as a powerful, and initially free, operating system. Through the 1980s, the market for UNIX systems had grown steadily, but had become fragmented. Arguments arose as vendors slowly tied the OS and features to proprietary systems.

In the 1990s, the open source community was becoming more popular, and the costs dropped for x86 processors on desktops and servers. Internet usage was rising, and the appetite for web consumption became insatiable. Companies were tasked with providing email and web content on servers that could handle exceptional growth.

Global Internet Users

The Solaris operating system, which sat on the Sun SPARC system based on the PowerPC platform, was lauded for its scalability and security. At the same time, an industry weary from fighting about the discrepancies of different UNIX systems saw promise elsewhere – in the newly created Linux OS. Combined with the gaining momentum of the open source movement, an industry saw a new opportunity.

By the mid-1990s, Linux started to gain traction, most notably in web hosting, network and simple database applications, hosted on open source MySQL and Postgres. However, the use of Linux for finance and other mission-critical systems was modest at best. As the importance of the web grew, so did the need for a strong level of standards, free of dominance by any one vendor. The Apache Web Server was born, providing a level playing field for the web, driving a de facto web standard. The extensibility of Apache via compiled modules let many developers create new features concurrently without requiring a highly coordinated or centralized development process.

The Approach

As personal web usage increased, Linux continued its steady development. People hosting web content needed an OS that could handle exponential traffic growth without seeing their expenses rise exponentially. The cost of proprietary systems was high, making them increasingly unattractive.

Linux offered utility in a world where server operating systems were at a premium. Price, performance and flexibility on how to deploy and modify was all better than proprietary systems. There were three keys to the Linux success story:

DECENTRALIZED DEVELOPMENT AND SHARED R&D

Developers could provide their patches on equal footing, regardless of their corporate affiliation. Heated debates happened in the open, and were often mediated by Torvalds. He was an authoritarian figure who provided consistency in the development process, but without exerting tight control.

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The architecture of kernel loadable modules allowed for many groups to deliver specific subsystems without the need for a high degree of coordination. This meant many disparate solutions could be developed independently to extend Linux without slowing the speed of core development. This collective intelligence and design made for an OS that could meet the needs of vendors and users without locking any group out of the ecosystem.

ACCESSIBILITY AND USER-LED INNOVATION

Historically, the users of software were left to the mercy of corporate vendors. These pools of users were limited by their ability to pay for the software, and were often not given access to the underlying code. Changes or requested features were either paid for, or users had to wait and hope that their feature (or bug fix) would be granted in the next release.

In Linux (and open-source software in general), the software and the means to fix or update software became accessible to anyone. Users dealing with firsthand problems could provide relevant feedback directly to the development process. Users could now freely use open-source software to solve their own problems.

PRAGMATISM

Linux provided a pragmatic view to open source. While some software factions preached freedom above all else, Linux is driven by a need to solve a problem. Initially, this was for Linus Torvalds to run a UNIX-like operating system on a PC. But over time, this has been expanded to provide a common, extensible platform – whether it's mobile (e.g., Android), gaming consoles or other embedded devices that need a highly specialized and adaptable OS.

Linux isn't an end unto itself. The Linux kernel is simply a building block that helps create and deliver an OS for running applications. Developing a non-differentiating technology through shared research and development frees up resources for companies to develop high-value applications.

The Results

From its beginning, when a young Finnish grad student revolutionized the computing world, Linux has become the ultimate Cinderella story.

Everyone loves an underdog, but that chapter has closed. Linux is now the OS of choice among users worldwide – open source is the default development methodology for users bringing solutions to market. Linux has spread its wings to industries and markets around the globe, including:

CARRIER DATA CENTERS

The Carrier Grade Linux (CGL) initiative launched in 2002, with UNIX dominating the data center marketplace. Solaris hosted more than 95% of telecommunications applications.

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To qualify as a "carrier grade" platform, Linux needed to cross gaps in performance, API standards, scalability, reliability, availability and tooling. Undaunted, the CGL workgroups tackled these challenges incrementally, enlisting players from across the IT industry, who would also benefit from new capabilities. Within five years, Linux was competing on an equal footing with legacy UNIX for telecoms. Today, Linux is considered the best option for carrier data center and cloud deployment.

FINANCIAL MARKETS

Speed matters in the world of stock trading and financial transactions. Once tied to proprietary systems with long release cycles, today's financial exchanges — NASDAQ, the London Exchange, the Tokyo Stock Exchange and a majority of others — now run on Linux.

The New York Stock Exchange Euronext, the largest exchange, runs on a Linux system that can generate 1.5 million quotes and process 250,000 orders every second, offering acknowledgements of each transactions within two milliseconds.

In addition to speed, the ability to customize and a revamped scheduler that keeps processes such as trades from being interrupted, have made Linux the gold standard in the financial industry.

CLOUD COMPUTING

More than half of senior enterprise IT executives expect the majority of IT workloads to reside in the cloud or co-location site in the future, according to a recent survey by the Uptime Institute. Of those, 70% expect the shift to happen in the next four years.

With more than 75% of cloud-enabled enterprises running Linux as their primary cloud platform, we expect to see a dramatic increase in Linux deployments to support the move to the cloud.

SMARTPHONES

In 2014, the Linux-based Android smartphone OS was shipped on more than 1 billion units, eclipsing the previous year's total smartphone sales.

SUPERCOMPUTING

Once dominated by highly specialized hardware and operating systems, Linux has become dominant in the supercomputing market. According to a November 2016 report by Top 500 (which ranks systems based on industry standard benchmarks), 99.6% of the top 500 most powerful computing systems ran Linux, with commercial UNIX (specifically AIX) accounted for the other 0.4%.

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EMBEDDED LINUX SUCCESS

Once a highly fragmented marketplace of more than 300 embedded operating systems, Linux now serves nearly every segment of intelligent device design. From industrial control to communications, networking, mobile/wireless, automotive, medical devices and beyond, Linux spans the gamut of embedded system types and form factors. Small, embedded systems, Internet of Things nodes, single-board computers and clusters of massively parallel blades are all benefiting from the Linux system.

From its humble beginning, Linux has grown into a vital technology, revolutionizing entire industries. We expect the open-source development model, proven successful by Linux, will continue to empower developers around the world to create similar communities to solve technical challenges together long into the future.

Reference: https://www.linuxfoundation.org/projects/case-studies/linux/

Questions

A. How many individual developers and companies involves in developing Linux as world's most dominant operating system? (2 marks)

B. Identify how many patches go into each kernel release and estimate number of manpower required to develop such patches. (2 marks)

C. Evaluate the software and collaboration problem due to increasing number of developer and tell how Linux founder solve that problem. (2 marks)

D. Summarize THREE (3) keys of Linux success factor. (3 marks)

E. List TWO (2) industries and markets that adopt Linux as their operating system. (1 marks)

End of Paper